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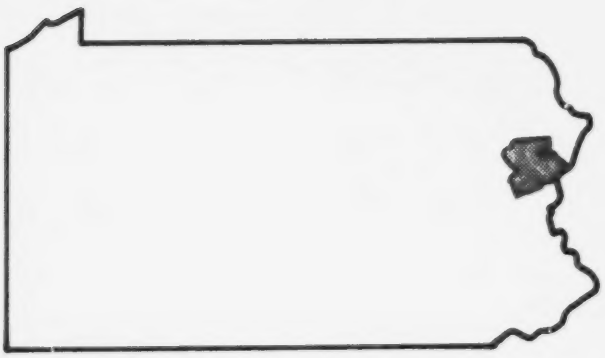
FEM

FLOOD INSURANCE STUDY

TOWNSHIP OF PRICE, PENNSYLVANIA
MONROE COUNTY



SEPTEMBER 2, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - **421894**

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Price, Monroe County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the Philadelphia District of the U. S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1822, Project Order No. 1, Amendment No. 16. This work was completed in February 1987.

1.3 Coordination

An initial Consultation and Coordination Officer's (CCO) meeting was held in December 1984 with representatives of FEMA and the township to identify the streams to be studied by detailed methods. A search for basic data was made at all levels of government. Maps were obtained from the community and the U. S. Geological Survey (USGS). On September 22, 1987, a final CCO meeting was held with representatives of FEMA, the town, and the COE (the study contractor) to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Price, Monroe County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

Brodhead Creek was studied by detailed methods for its entire length within the community. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through February 1992.

Big Bush Kill Creek was studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Township of Price.

2.2 Community Description

The Township of Price is located in Monroe County, covering an area of approximately 24.6 square miles. It is bordered by the Township of Barrett to the north, the Townships of Porter and Middle Smithfield to the east, the Townships of Stroud and Smithfield to the south, the Township of Pocono to the southwest, and the Township of Paradise to the west. Price had a population of 684 in 1980, with a forecasted population of 875 in 1990 (Reference 1).

The Township of Price was incorporated from the Township of Smithfield in 1798. Price has the largest portion of undeveloped land, 94 percent, within the county. Approximately 900 acres are developed, with approximately 550 acres of that as residential development. The terrain is predominantly mountainous with a few scattered swampy areas.

Brodhead Creek flows in a southern direction along the western portion of the township. Along with its tributaries, Brodhead Creek drains the majority of the township.

The climate in this geographic area is characterized by temperatures ranging from an average high of 68 degrees Fahrenheit (^{o}F) in summer and to an average low of 30^{o}F in winter. The average annual rainfall for the region is 44 inches.

2.3 Principal Flood Problems

The principal flood problems in the Township of Price are associated with Brodhead Creek. A review of newspaper accounts reveals that

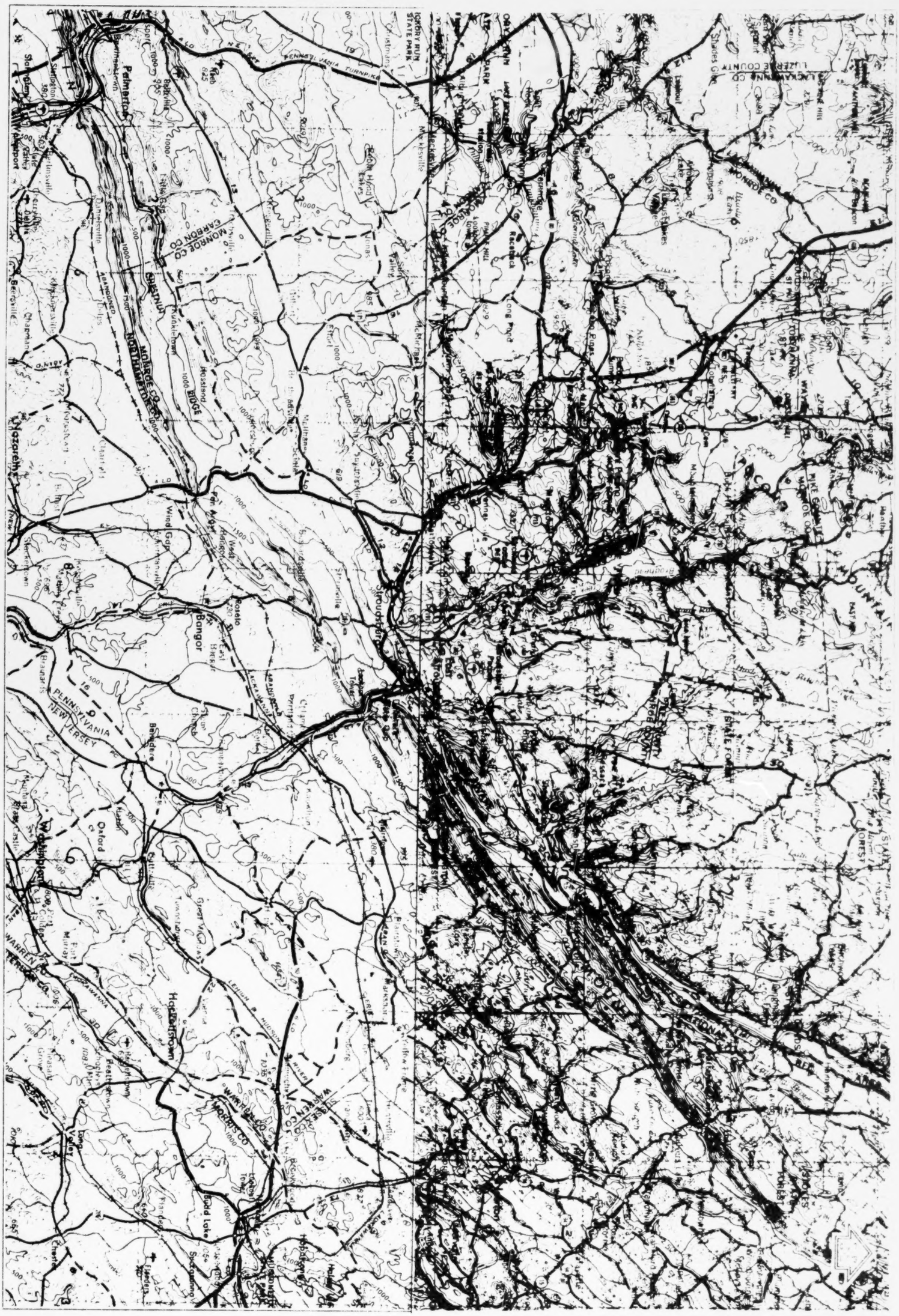


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PRICE, PA

(MONROE CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

the most severe flood disaster in northeastern Pennsylvania occurred in August 1955. There was extensive physical damage and loss of life along Brodhead Creek between Canadensis in the Township of Barrett and Analomink in the Township of Stroud, where more than 35 people lost their lives. Another disastrous flood occurred in July 1969, causing devastating property damage.

2.4 Flood Protection Measures

There are no structural flood protection measures located in the Township of Price. Residents of the community depend on the usual warnings issued through radio, television, and local newspapers for information concerning possible flood conditions. Flood warnings and predicted flood peaks are issued by the National Oceanic and Atmospheric Administration Flood Forecasting Centers located at Harrisburg, Pennsylvania, and Trenton, New Jersey.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. A flood event of a magnitude which is expected to be equaled or exceeded once on the average during any 100-year period (recurrence interval) has been selected as having special significance for floodplain management and for flood insurance rates. This event, commonly termed the 100-year flood, has a 1 percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for the flooding source studied in detail affecting the community.

A flood flow frequency analysis was performed on data from USGS gage No. 01440400 on Brodhead Creek near Analomink. The methodology in Bulletin 17B was used to analyze existing records (Reference 2). Discharges upstream of the gage location were determined using a drainage area proportion.

A summary of the drainage area-peak discharge relationships for the stream studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGE (cfs) 100-YEAR
BRODHEAD CREEK		
At downstream corporate limits	68.9	16,400
Upstream of confluence with Unnamed Tributary	66.8	15,700
Upstream of confluence with Pine Mountain Run	61.2	14,600
Upstream of confluence with Poplar Run	57.8	13,800
Upstream of confluence with Stony Run	46.9	11,250

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analysis of Brodhead Creek were photogrammetric and/or field surveyed and were located at close intervals above and below bridges and culverts in order to compute the significant backwater effects of these structures (Reference 3). The ground control for the photogrammetry was acquired using aerial surveying techniques (Reference 4).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 5). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The starting water-surface elevation for Brodhead Creek was obtained from normal depth computations, as appropriate. The results of the water-surface computations are tabulated for selected cross sections (Table 2).

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field

FLOODING SOURCE		STREAM CHANNEL			LEFT OVERBANK			RIGHT OVERBANK			100 YEAR FLOOD WATER SURFACE ELEVATION
CROSS SECTION	DISTANCE (FT.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	
A	500	50	7750	14.3	75	1790	5.3	640	6870	5.4	579.1
B	2625	80	7470	7.7	355	2820	2.0	600	6110	2.2	587.0
C	4400	40	6640	14.8	215	3800	4.9	400	3760	3.8	583.0
D	6025	80	10000	10.1	110	1580	2.9	215	4120	3.3	601.0
E	7650	85	10830	10.8	45	1160	5.8	110	3710	6.3	610.3
F	9950	45	9820	17.7	165	3490	4.9	60	2590	6.3	634.1
G	12150	115	10840	8.7	80	900	2.8	845	3960	2.2	647.4
H	13075	120	10850	10.7	205	2590	3.3	190	2280	3.8	650.8
I	14025	80	8150	8.8	285	7200	3.4	135	2350	1.9	655.1
J	16000	55	8810	15.8	40	980	4.8	885	4820	4.3	670.8
K	17700	50	4280	8.2	210	2230	2.4	1155	6090	2.4	681.2
L	19275	85	10150	16.3	55	1020	5.9	150	2050	4.9	690.4
M	20880	95	10800	8.7	255	2770	2.4	15	180	2.1	709.5

(1) Topwidth adjusted due to ineffective flow areas.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Township of Price
Monroe County
Pennsylvania

REGULATORY DATA

Brodhead Creek

FLOODING SOURCE		STREAM CHANNEL			LEFT OVERBANK			RIGHT OVERBANK			100 YEAR FLOOD WATER SURFACE ELEVATION
CROSS SECTION	DISTANCE (FT.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT/SEC)	WIDTH (FT)	DISCHARGE (CFS)	MEAN VELOCITY (FT/SEC)	WIDTH (FT)	DISCHARGE (CFS)	MEAN VELOCITY (FT/SEC)	
N	22200	40	6910	18.6	145	6190	7.6	30	700	5.7	723.0
O	23700	85	10640	11.7	195	2850	3.9	20	310	3.3	737.8
P	24700	55	8240	17.3	105	4580	7.2	60	980	5.3	747.8
Q	25575	80	9820	13.4	55	470	3.6	65	960	5.2	758.7
R	26650	50	4630	12.9	55	680	4.2	285	5940	5.0	770.4
S	27625	75	8200	14.0	25	390	4.2	245	2670	4.2	782.4
T	29525	90	8000	8.8	130	2300	3.5	75	960	2.9	794.7
U	31850	75	2200	7.2	75	460	2.5	805	8590	3.3	806.3
V (1)	33200	85	5560	9.2	635	1010	2.8	195	4680	4.1	814.4
W	33850	50	3100	8.4	30	320	2.9	815	7830	2.9	818.0
X	34550	45	2580	8.4	50	200	2.4	895	8470	3.0	821.5
Y (1)	35650	100	7100	10.8	595	2420	2.9	735	1730	2.2	830.1
Z	36600	35	4970	15.2	30	840	5.7	410	5440	4.3	839.3

(1) Topwidth adjusted due to ineffective flow areas.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Township of Price
Monroe County
Pennsylvania

REGULATORY DATA

Brodhead Creek (continued)

observations of the stream and floodplain areas (Reference 6). The roughness values for Brodhead Creek ranged from 0.045 in the channel to 0.090 in the overbank areas.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For the stream studied in detail, the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 7).

For the stream studied by approximate methods, the boundary of the 100-year flood has been delineated using the Flood Hazard Boundary Map for the Township of Price (Reference 8).

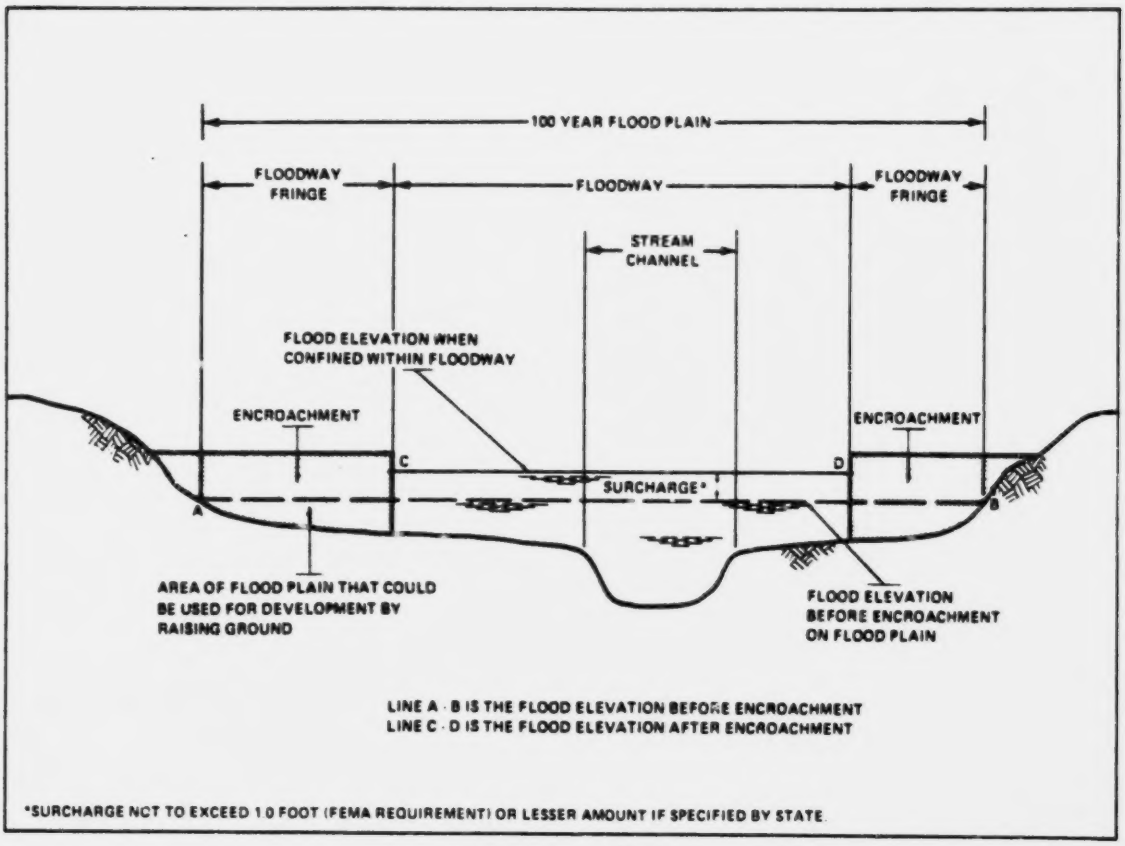
The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and

increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 2

No floodways were calculated as part of this study.

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain,and to areas of 100-year flooding where average depths are less than 1 foot, areas of 10-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplain. The locations of selected cross sections used in the hydraulic analyses are shown where applicable.

7.0 OTHER STUDIES

Flood Insurance Studies have been prepared for the Townships of Pocono, Stroud, and Porter (References 9, 10, and 11). The results of this study are in complete agreement with the results of those studies.

Flood Insurance Studies are currently being prepared for the Townships of Barrett and Paradise (References 12 and 13). The results of those studies will be in complete agreement with the results of this study.

Due to its more detailed nature, this study supersedes the Flood Hazard Boundary Map for the Township of Price (Reference 8).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

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8. Federal Emergency Management Agency, Federal Insurance Administration, Flood Hazard Boundary Map, Township of Price, Monroe County, Pennsylvania, June 13, 1980.

9. Federal Emergency Management Agency, Flood Insurance Study, Township of Pocono, Monroe County, Pennsylvania, Washington, D. C., August 5, 1986.

10. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Township of Stroud, Monroe County, Pennsylvania, Washington, D. C., April 15, 1977.

11. Federal Emergency Management Agency, Flood Insurance Study, Township of Porter, Pike County, Pennsylvania, Washington, D. C., October 15, 1985.

12. Federal Emergency Management Agency, Flood Insurance Study, Township of Paradise, Monroe County, Pennsylvania (Unpublished).

13. Federal Emergency Management Agency, Flood Insurance Study, Township of Barrett, Monroe County, Pennsylvania (Unpublished).

Parcel Lines Map, "Community Map, Price Township Monroe County, Pennsylvania," February 1983.

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	10	827.95	Snow Hill Road bridge over Brodhead Creek. Square cut in top of downstream bridge wall at southeast abutment.
RM 2	15	705.82	Alpine Mountain Ski Area access road bridge over Brodhead Creek. Square cut on top of downstream bridge wall at south embankment.

FLOOD PROFILES

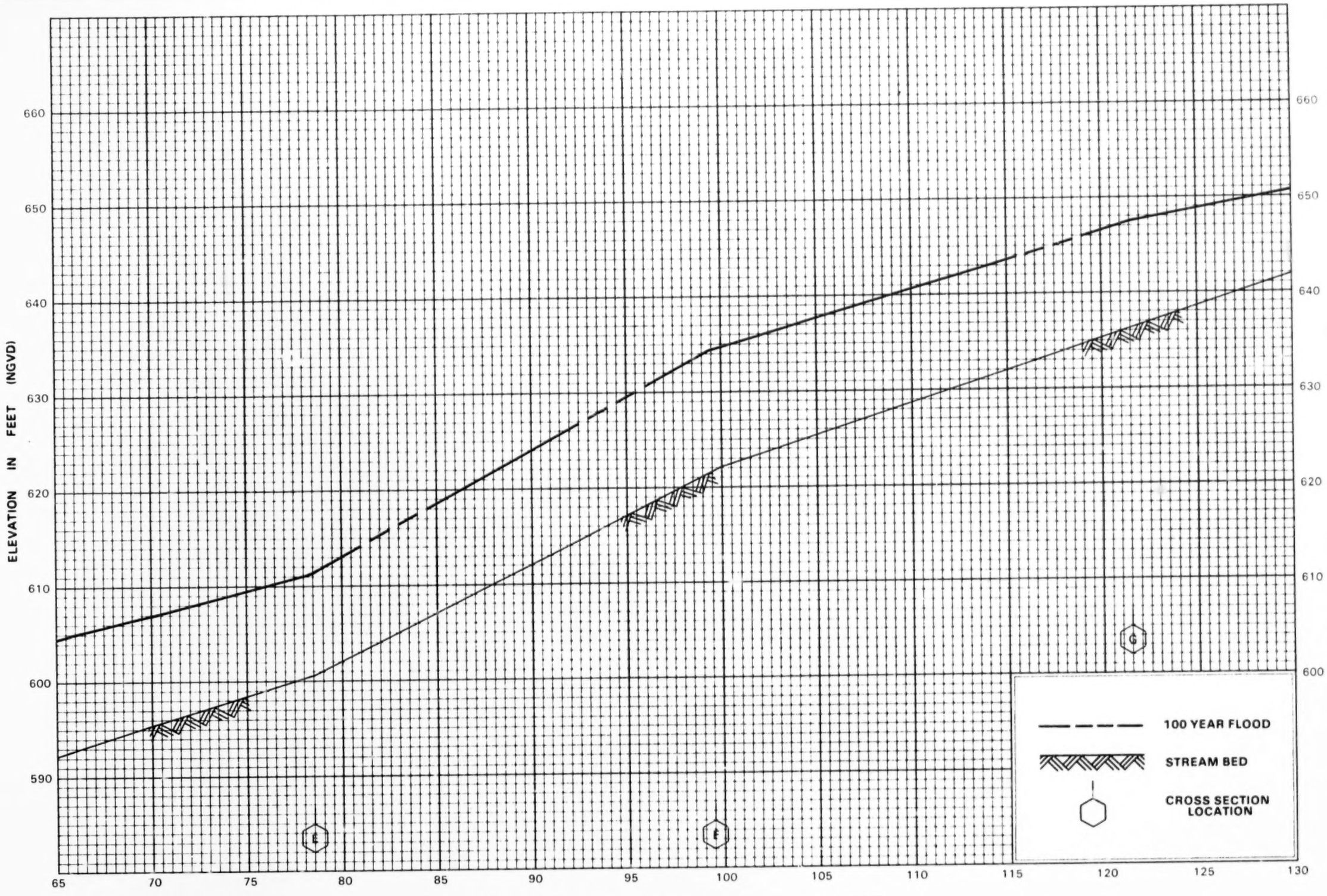
BRODHEAD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PRICE, PA

(MONROE CO.)

01P



FLOOD PROFILES

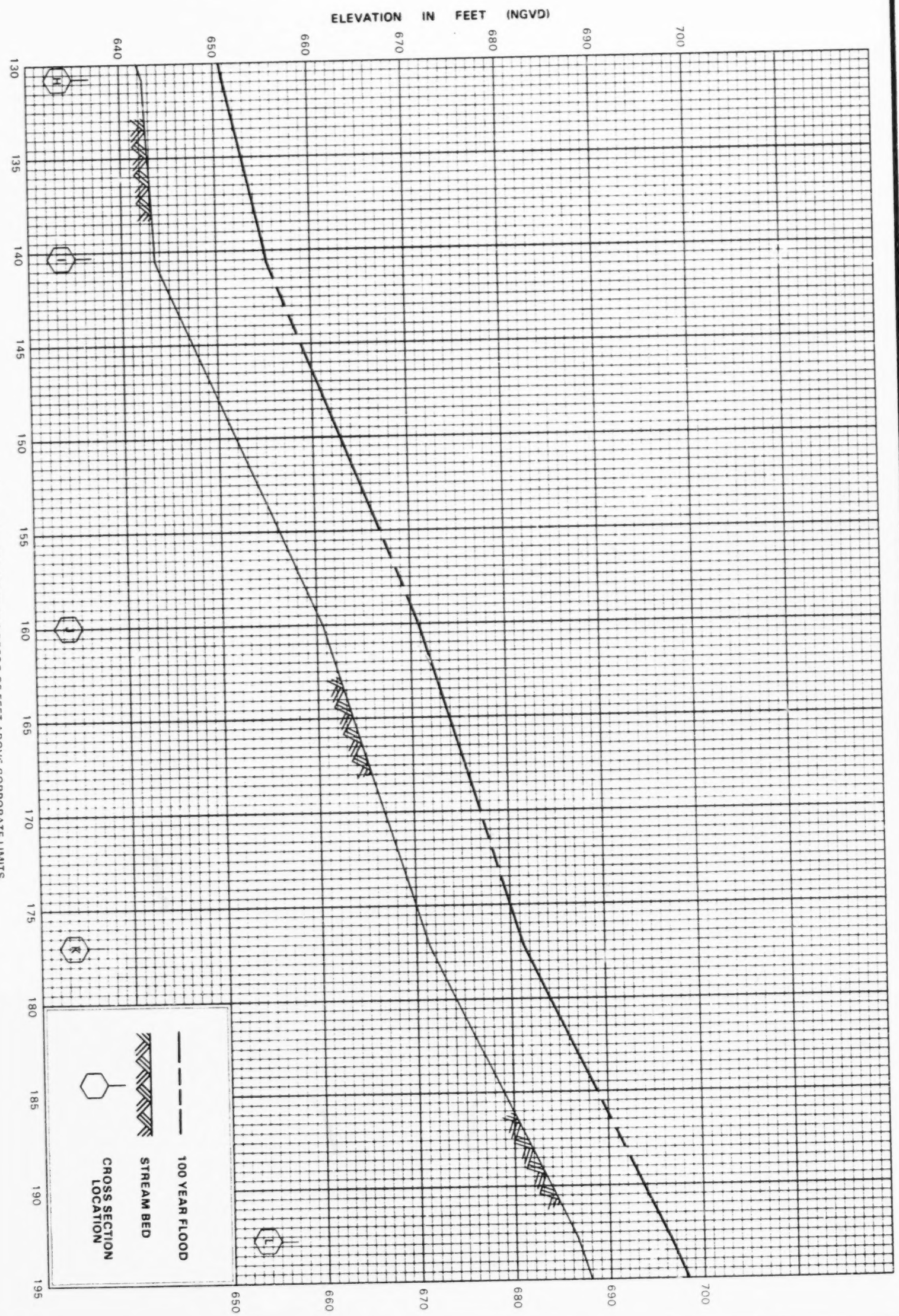
BRODHEAD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PRICE, PA

(MONROE CO.)

02P



FEDERAL EMERGENCY MANAGEMENT AGENCY

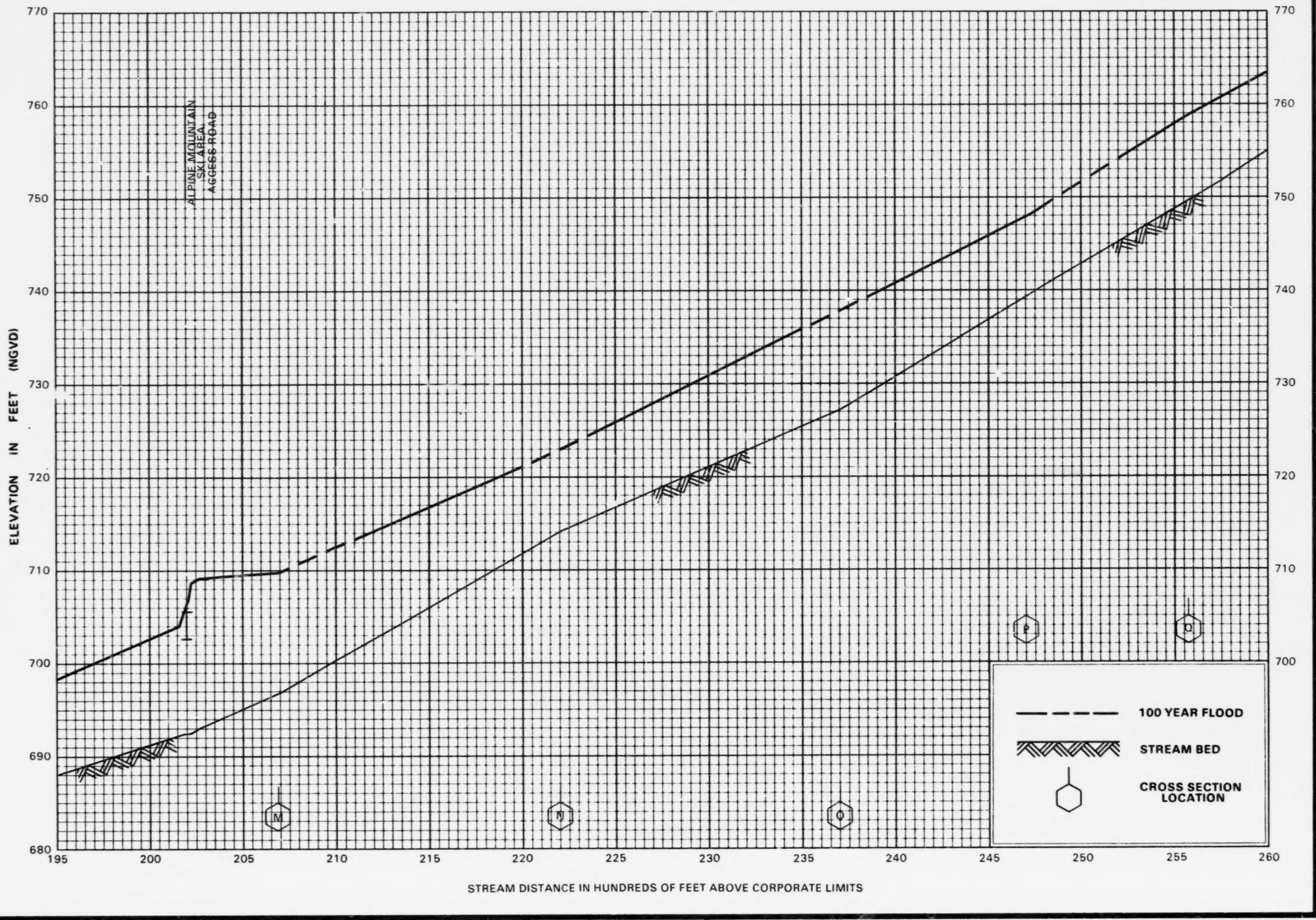
TOWNSHIP OF PRICE, PA

(MONROE CO.)

FLOOD PROFILES

BRODHEAD CREEK

03P



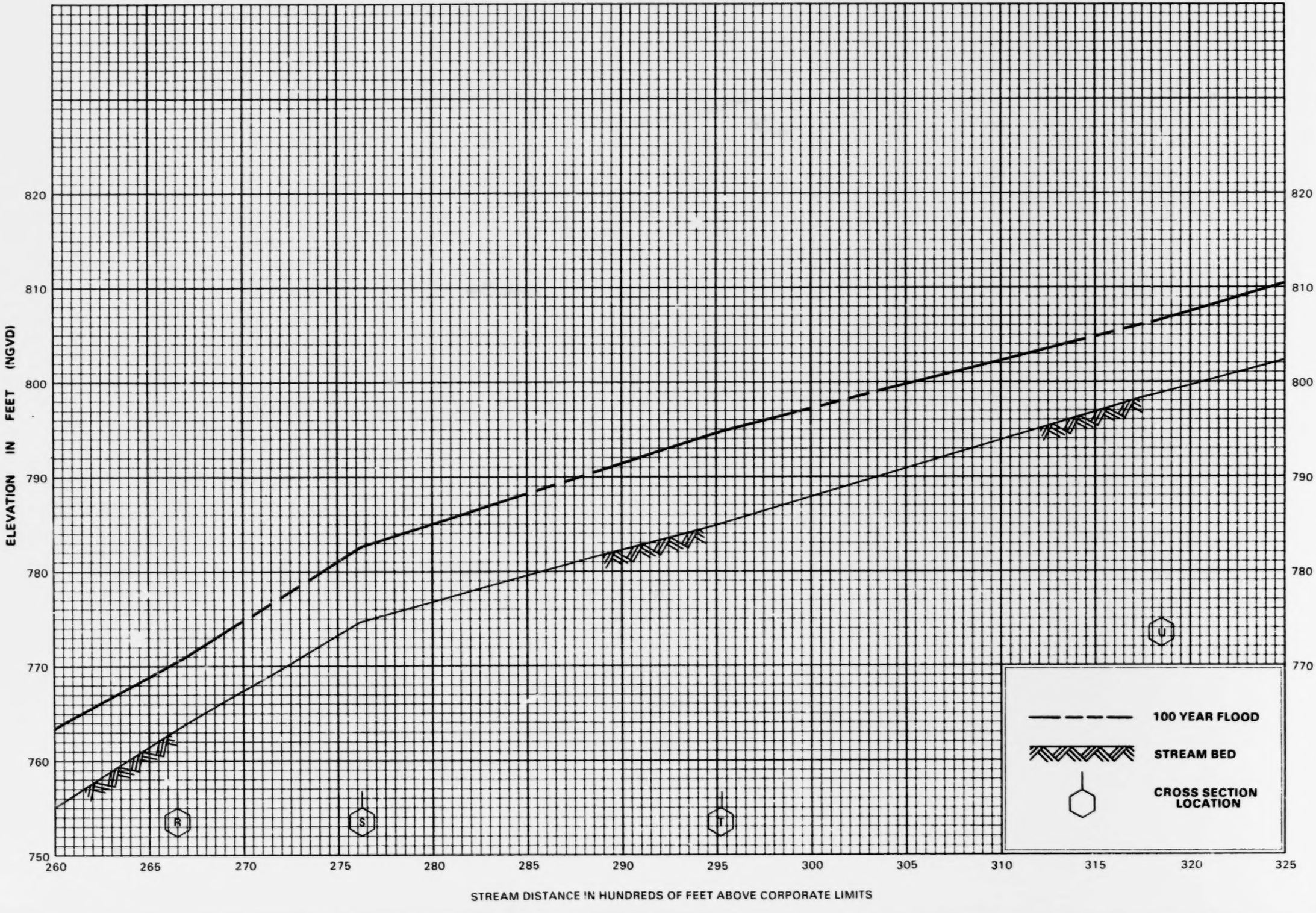
FLOOD PROFILES

BRODHEAD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PRICE, PA
(MONROE CO.)

04P



FLOOD PROFILES

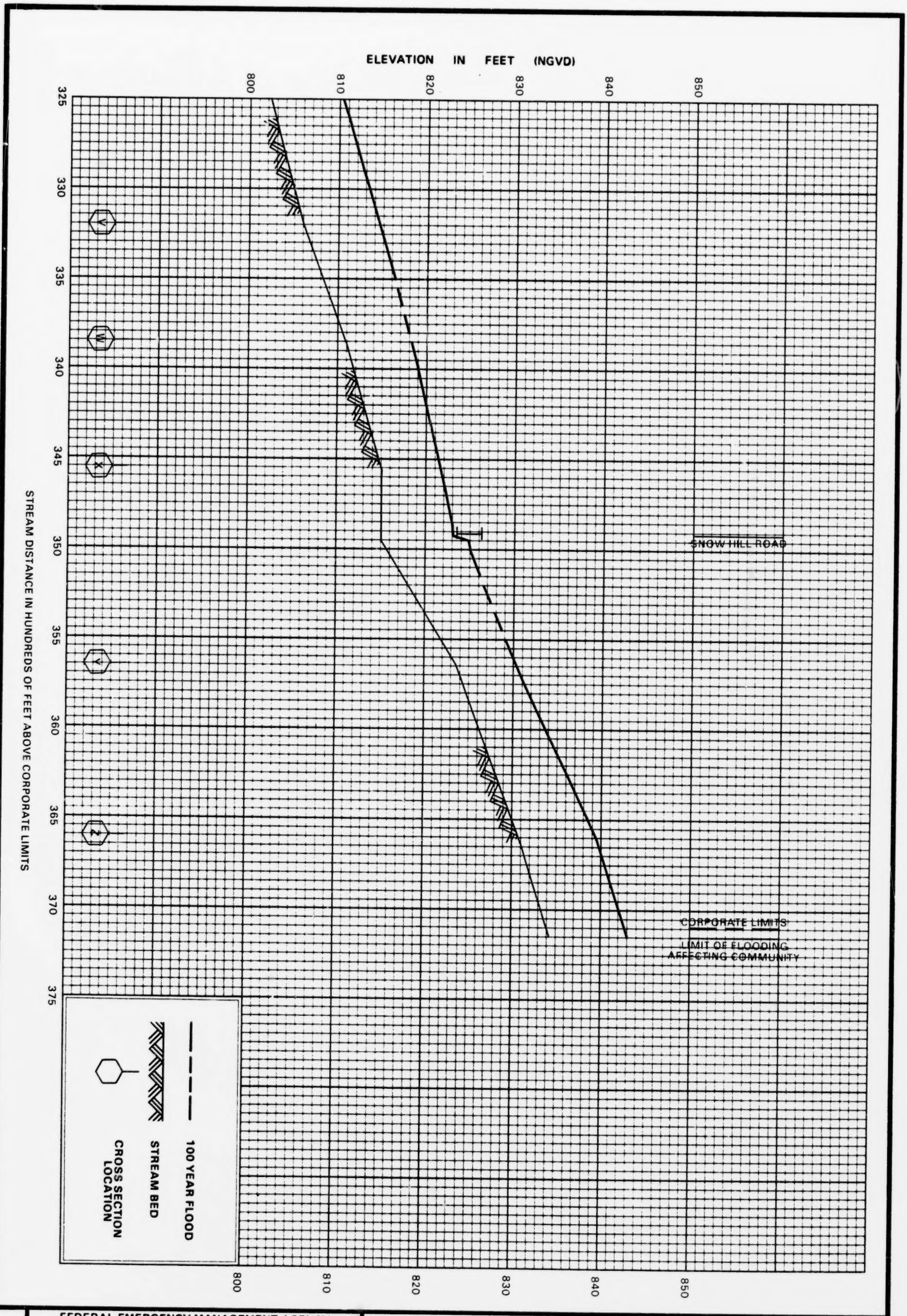
BRODHEAD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PRICE, PA

(MONROE CO.)

05P



06P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PRICE, PA

(MONROE CO.)

FLOOD PROFILES

BRODHEAD CREEK